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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

CARDING MACHINE OPERATOR 8-27.77

B-290 or S-50

TM 001 242

U. S. Employment Service in
Cooperation with
Pennsylvania State Employment Service

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
May 1954

GATB #2019
January 1954

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR CARDING MACHINE OPERATOR 8-27.77

B-290 or S-50

Summary

During the period of December 28, 1953 to January 8, 1954, the GATB, B-1002A, was administered to a sample of 51 women employed as Carding Machine Operators 8-27.77 by the Williamsport Narrow Fabrics Company of Williamsport, Pennsylvania. The criterion consisted of rank-order supervisory ratings converted to linear scores. On the basis of mean scores, standard deviations, correlations with the criterion and job analysis data, and their combined selective efficiency, Aptitudes K - Motor Coordination and M - Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Carding Machine Operator 8-27.77 - B-290 or S-50

Table I shows, for B-1001 and B-1002, the minimum acceptable scores for each aptitude included in the test norms for Carding Machine Operator 8-27.77.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-290 or S-50

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
T	CB-1-G CB-1-K	85	K	Part 8	90
M	CB-1-M CB-1-N	90	M	Part 9 Part 10	85

Effectiveness of Norms

The data in Table IV indicate that 10 of the 17 poor workers, or 59% of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 59% of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover 29 of the 36 workers who made qualifying test scores, or 81%, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Carding Machine Operator 8-27.77.

II. Sample

Fifty-one women employed as Carding Machine Operators 8-27.77, by the Williamsport Narrow Fabrics Company, Williamsport, Pennsylvania, were tested between December 28, 1953 and January 8, 1954. The sample of 51 included all the women on this job at the time of testing.

The training consists of demonstration and explanation by the Floorlady. Four weeks of training is considered the maximum that should be required for learning the job.

There are no special age, education or experience requirements.

Table II shows the means, standard deviations, ranges, Pearson product-moment correlations with the criterion and the standard errors of correlation for age, education and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, Pearson Product-Moment Correlations with the Criterion (r) and the Standard Errors of Correlation (σ_r) for Age, Education, and Experience

Carding Machine Operator 8-27.77
N = 51

	M	σ	Range	r	σ_r
Age (years)	28.1	10.2	17-46	.081	.139
Education (years)	10.3	1.5	7-12	.073	.139
Experience (months)	36.1	55.4	1-216	.045	.140

There are no significant correlations between age, education or experience and the criterion. The sample does not appear to be homogeneous with respect to any of these variables.

III. Job Description

Job Title: Carding Machine Operator 8-27.77

Job Summary: Winds ric-rac or bias binding on paperboard cards, using a carding machine which stops automatically after a pre-determined number of turns, resulting in a measured length of fabric on card.

Work Performed

Prepares to card fabric: Reaches to box of cards at left of machine and grasps handful to provide convenient supply for picking up with right hand. Reaches down to stack of empty boxes on floor and lifts one to slanted support on table to prepare for easy filling with completed cards. Threads end of fabric through guide by pulling guide open and pulling end through with fingers of either hand.

Winds fabric on cards: Pulls end of ric-rac or bias binding from guide with left hand and at the same time picks up one card from pile on table with right hand. Spreads end of fabric along upper side of card and pushes both between plates of card holder to secure for winding. Bumps starting lever with left forearm or left hand to cause machine to make one winding cycle. After machine stops holds fabric between thumb and third finger of left hand and between first and second fingers at another point to prepare to cut. Cuts fabric with scissors held in right hand and, while lifting two or three turns with fingers of left hand to separate these strands from others on card, deftly reaches through under lifted strands with point of scissors held in right hand and, with a deft hand and wrist motion, hooks loose end under to prevent unwinding. Presses down lifted strands with fingers of left hand to make them hold ends more securely. Pulls filled card out of card holder with right hand and stacks in box on sloping support at right of machine. Lifts filled boxes from support and places on rear of work table for removal by floor girl.

Pins breaks: Detects faults in fabric by feeling as strand runs through right hand, or by sight if fabric catches in guides of machine. Cuts off ragged ends of broken fabric or cuts out pieces with scissors to remove damaged portions and pins ends with straight pin taken from pile on table by pushing through both layers of fabric while holding ends superimposed with left hand. Winds to complete card. May unwind strands by hand and rewind if material winds off end of card.

Makes out piece work tickets: Reads number of cards in tray from counter on machine and notes on ticket along with worker's initials to provide record for piece work payment. Turns counter back to zero to prepare for succeeding box. Places ticket in completed box.

Notifies mechanic of faulty operation: Calls mechanic if machine fails to operate properly and explains difficulty.

IV. Experimental Battery

All of the tests of the GATB, B-1002 Form A, were administered to most of the sample group. Six of the group had been tested with part or all of the B-1001 edition of the GATB. Two were counseling cases and had been given the entire GATB, B-1001. The other four had taken specific aptitude test batteries based on the GATB, B-1001. They were given the entire GATB, B-1002A, but B-1002

scores on those parts administered previously were ignored, and the B-1001 scores converted to corresponding B-1002 test scores. In all cases where B-1001 data were used, the raw scores were converted to equivalent B-1002 raw test scores before the conversion to aptitude scores.

V. Criterion

The criterion consisted of rank order ratings made by the Assistant Superintendent. For statistical analysis these rank order ratings were converted to linear scores.

VI. Statistical and Qualitative Analysis

Table III shows the means, standard deviations, Pearson product-moment correlations with the criterion and standard errors of correlation for the aptitudes of the GATB.

The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), Pearson Product-Moment Correlations with the Criterion (r) and Standard Errors of Correlation (σ_r) for the Aptitudes of the GATB

Carding Machine Operator 8-27.77
N = 51

Aptitudes	M	σ	r	σ_r
G-Intelligence	91.0	14.3	.236	.132
V-Verbal Aptitude	92.0	14.9	.133	.138
N-Numerical Aptitude	94.0	15.5	.289*	.128
S-Spatial Aptitude	89.7	16.9	.111	.138
P-Form Perception	98.3	19.0	.200	.134
Q-Clerical Perception	100.7	12.6	.161	.136
K-Motor Coordination	102.1	13.1	.270	.130
F-Finger Dexterity	102.9	17.5	.137	.137
M-Manual Dexterity	98.9	17.0	.348*	.123

*Significant at the .05 level.

The statistical results were interpreted in the light of job analysis data. The job analysis indicated that the following aptitudes measured by the General Aptitude Test Battery appeared to be important for this occupation:

Motor Coordination (K) - required to insert tapes quickly in guide and cards in holder.

Finger and Manual Dexterity (F and M) - required to handle the cards skillfully and to tuck the ends of the tapes under the other strands deftly.

The highest mean scores, in order of magnitude, were obtained for Aptitudes F, K, Q, M and P, respectively. All of the aptitudes have standard deviations of less than 20, with Aptitudes Q and K exhibiting the smallest standard deviations.

When N = 51, correlations of .358 and .276 are significant at the 1% level and 5% level, respectively. Aptitudes M and N correlate significantly with the criterion at the 5% level of confidence. On the basis of importance as indicated by the job analysis data, high mean score and low standard deviation, Aptitude K was included in the test norms. On the basis of job analysis data, high mean score and significant correlation with the criterion, Aptitude M was included in the test norms.

Although there is some statistical evidence to warrant the inclusion of Aptitudes Q, N and P, they did not seem to be important in the jobanalysis. Therefore, these aptitudes were omitted from the test norms. There is also some statistical evidence and indications in the job analysis for the inclusion of Aptitude F in the test norms. However, the addition of Aptitude F tends to lower the predictive value of norms which include Aptitudes K and M. Therefore, Aptitude F was omitted from the test norms.

The minimum score for Aptitude K was set at one standard deviation below the mean and rounded to the nearest five point score level. This resulted in a minimum score of 90 for Aptitude K. The minimum score for Aptitude M was set at one standard deviation below the mean and rounded to the higher adjacent five point score level, which yielded the best selective efficiency for the norms. This resulted in a minimum score of 85 for Aptitude M.

For the purpose of computing the tetrachoric correlation coefficient and Chi Square, the criterion was dichotomized so that one-third of the sample was placed in the low criterion group. The 34 workers who received linear scores of 42 or more were placed in the high criterion group, and the 17 workers who received linear scores of 41 or less were placed in the low criterion group. Table IV shows the relationship between test norms consisting of Aptitudes K and M with critical scores of 90 and 85, respectively and the dichotomized criterion for Carding Machine Operator 8-27.77. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship Between Test Norms Consisting of Aptitudes K and M with Critical Scores of 90 and 85, Respectively and the Criterion for Carding Machine Operator 8-27.77

N = 51

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	5	29	34
Poor Workers	10	7	17
Total	15	36	51

$r_{tet} = .69$ $\quad X^2 = 8.606$

$r_{tet} = .24$ $\quad P/2 < .005$

The data in the above table indicate a significant relationship between the norms and the criterion for this sample.

VII. Conclusions

On the basis of job analysis data, mean scores, correlations with the criterion and their combined predictive efficiency, Aptitudes K and M with minimum scores of 90 and 85, respectively are recommended as norms on the GATB, B-1002, for the occupation of Carding Machine Operator 8-27.77. The equivalent norms for the B-1001 edition of the GATB consist of T-85 and M-90.